OPERATION & MAINTENANCE HANDBOOK

MODEL 217

DATA GENERATOR

Part Number 37000-849

INSTRUMENT REGISTRY

SYSTRON-DONNER CORPORATION

DATAPULSE

10150 W. Jefferson Blvd., Culver City, Calif. 90230

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OPERATION & MAINTENANCE

HANDBOOK

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MODEL 217

DATA GENERATOR

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DATAPULSE
DIVISION
SYSTRON DONNER
CORPORATION

10150 W. JEFFERSON BLVD., CULVER CITY, CALIFORNIA 90230

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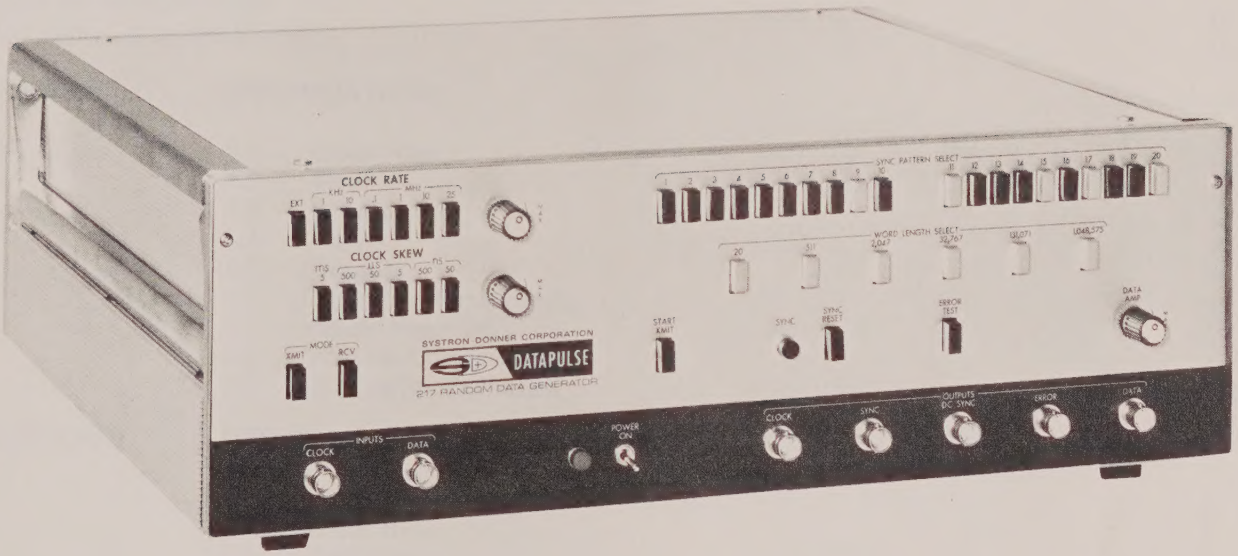

MODEL 217 DATA GENERATOR

The Model 217 Data Generator is a highly versatile and reliable laboratory instrument, capable of generating pseudo-random sequences up to 1,048,575 bits at repetition rates up to 25 MHz. The instrument also provides a bit-for-bit check on external pseudo-random data. Each detected error generates a pulse at the error output that can be counted by an external monitor. The Model 217 functions as a word generator when the 20 bit word length is selected. The state of each bit (20 bit word length) can be individually programmed by front panel pushbuttons. The sync pattern can be selected by front panel pushbuttons, thus providing the capability of synchronizing at any point in the random sequence.

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5.1 General Description 5-1

LIST OF SCHEMATICS

Drawing Number	Description
41000-255	Block Diagram – Model 217 Data Generator
40000-433	Schematic – Front End
40000-434	Schematic – Logic
40000-435	Schematic – Outputs
40000-232	Schematic – Power Supply
37000-843	Assembly – Main Circuit Board

LIST OF ILLUSTRATIONS

Figure Number	Title	
2-1	Model 217 Controls and Connectors	2-2

SECTION I

SPECIFICATIONS

1.1 CLOCK RATE

1.1.1 Internal

Continuously variable from 100 Hz to 25 MHz in 6 ranges.

1.1.2 External

Instrument may be driven by an external source at rates from dc to 25 MHz. Clock pulse must have an amplitude of at least +1 volt and a duration of at least 5 ns.

1.2 MODE

1.2.1 Transmit

In this mode, the instrument transmits a pseudo-random sequence of selected length. In the 20 bit-word length, the state of each bit can be individually selected by means of front panel pushbuttons.

1.2.2 Receive

In this mode, the instrument receives, synchronizes and error checks data from an external source. The external data sequence must be the same as the sequence generated by the instrument in the transmit mode.

1.3 WORD LENGTH

Words of the following length may be selected by front panel pushbuttons:

20
511
2,047
32,767
131,071

1.4 INPUTS

1.4.1 Data

Data format must be NRZ and data must have an amplitude of +1 volt minimum. Transition times must be $\leq$10% of bit period.

1.4.2 Clock

Clock input must be at least +1 volt amplitude and have a width of $\geq$5 ns.

1.5 OUTPUTS

All outputs, except the DC SYNC, have a minimum amplitude of +2 volts into 50 ohms and transition times of $\leq$5 ns.

1.5.1 DC Sync

A dc signal is produced when synchronization is acquired.

1.6 OPERATING TEMPERATURE

0^{o} to 50^{o} C.

1.7 POWER REQUIRED

Approximately 150 W, 50–60 Hz at 105–125/210–250 V ac selectable by means of a multitap transformer and a range switch on the back panel.

1.8 PHYSICAL CHARACTERISTICS

The front and back panels are die cast and the face plates have a brushed aluminum finish with etched and filled markings. All input and output connectors are BNC type. Dimensions are 16¾" W x 5¼" H X 15¾" D. Weight is 20 pounds.

1.9 ACCESSORIES FURNISHED

An 8-foot power cord with a 3-prong connector and one operation and maintenance handbook.

SECTION II

CONTROLS AND CONNECTORS

2.1 POWER

Applies ac voltage to the primary of the power transformer and the blower motor and illuminates the pilot lamp.

2.2 CLOCK RATE

Selects either external triggering, or one of six overlapping clock ranges when the instrument is being triggered by the internal clock. The vernier control provides continuous clock rate adjustment within each range.

2.3 CLOCK SKEW

Delays the clock pulse to allow for synchronization with external data. Six pushbuttons provide for selection of six overlapping ranges and the vernier control provides continuous adjustment within each range.

2.4 MODE

In the TRANSMIT mode the instrument transmits pseudo-random sequences of a selected length.

In the RECEIVE mode the instrument receives, synchronizes and error checks external data.

2.5 SYNC PATTERN SELECT

Selects the point on the external data where synchronization will occur. When the pattern on the incoming data matches the pattern of the pushbuttons, a sync pulse is generated.

2.6 WORD LENGTH SELECT

Determines the length of the pseudo-random word when the instrument is in the transmit mode.

2.7 START XMIT

Sets the shift register to correspond to the setting of sync pattern select pushbuttons.

2.8 SYNC RESET

Synchronizes data with the sync pattern.

2.9 ERROR TEST

Manually generates an error signal at the ERROR output.

2.10 DATA AMP

Adjusts the amplitude of the output data.

2.11 INPUTS

2.11.1 Clock

Input connector for an external clock source.

2.11.2 Data

Input connector for external data.

2.12 OUTPUTS

2.12.1 Clock

Output connector for the clock pulse.

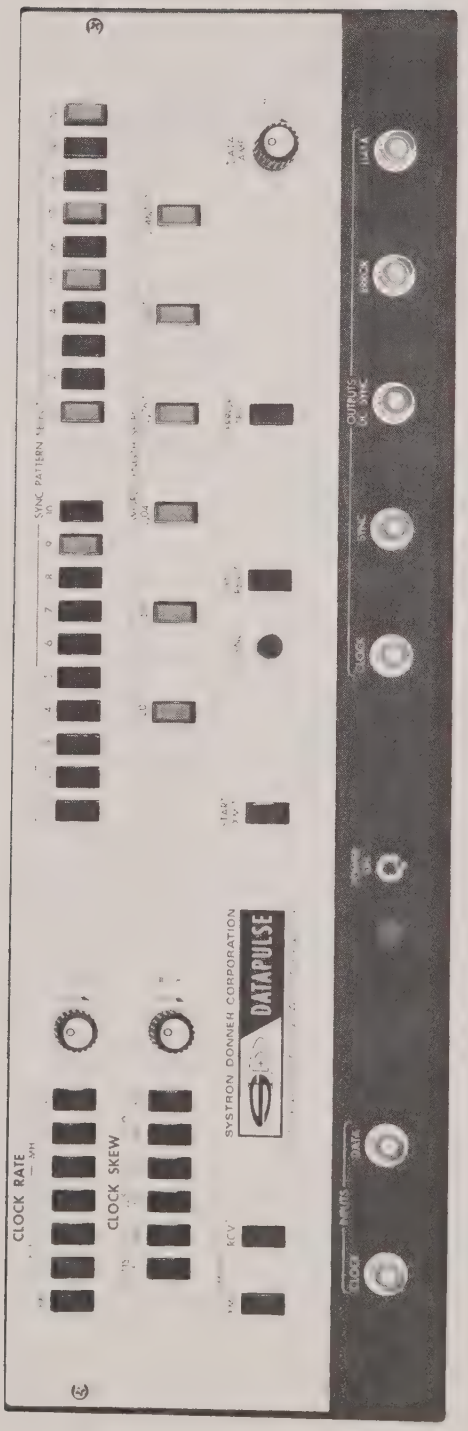


Figure 2-1. Model 217 Controls and Connectors.

2.12.2 Sync

Output connector for the sync pulse.

2.12.3 DC Sync

A 2 volt dc level is produced at this connector when sync is acquired.

2.12.4 Error

Output connector for monitoring data errors when the instrument is in the receive mode.

2.12.5 Data

Output connector for data when the instrument is in the transmit mode.

SECTION III

OPERATION

The following procedure provides a brief operational check of the instrument and an introduction to its controls.

3.1 EQUIPMENT (or equivalent) REQUIRED

a. Real-time oscilloscope with a bandpass of dc to 50 MHz. Tektronix 546 with a Type 1A2 plug-in recommended.

b. Sampling plug-in with a 0.35 ns rise time. Tektronix 1S1 recommended.

c. Pseudo-random data source capable of generating the same data sequences and word lengths as the Model 217. Datapulse Model 217 Data Generator recommended.

d. A 50 ohm 1 watt termination. Tektronix Type 017-0078-00 recommended.

e. Two 50 ohm coaxial cables terminated with BNC connectors.

3.2 TRANSMIT OPERATION

CAUTION

Verify that the 115/230 volt slide switch on the back panel agrees with the line voltage prior to connecting the power plug.

a. Connect the instrument to the power source. Actuate the power switch to ON and verify that the power indicator illuminates.

b. If the sync indicator is not on, depress the START XMIT and SYNC RESET pushbuttons.

c. Set the instrument controls as follows:

Control	Setting
CLOCK RATE	10 MHz
VERNIER	fully clockwise
MODE	XMIT
SYNC PATTERN SELECT	no. 1 depressed; all others released
WORD LENGTH SELECT	no. 20 depressed
DATA AMP	fully clockwise

d. Monitor the CLOCK output on the 1S1 sampling plug-in. Terminate with 50 ohms at the oscilloscope.

e. Verify that clock pulses of approximately 2 volts amplitude are displayed.

f. Rotate the clock rate vernier counterclockwise and verify that the clock rate decreases to less than 1 MHz.

g. Check the remaining clock rate ranges on the counter and verify that each range overlaps at its upper and lower limits.

h. Disconnect the CLOCK output from the oscilloscope. Set the instrument to the 10 MHz clock rate range.

i. Monitor the SYNC output on the 1S1 sampling plug-in. Terminate with 50 ohms at the oscilloscope. Verify that sync pulses of approximately 2 volts amplitude are displayed.

j. Disconnect the SYNC output from the sampling plug-in and connect it to the external trigger input. Set the oscilloscope for external triggering.

k. Remove the sampling plug-in and install the 1A2 real-time plug-in. Connect the DATA output to the oscilloscope vertical input. Terminate with 50 ohms at the oscilloscope.

l. Set the oscilloscope horizontal controls to display two pulses, one starting at the first graticule, the other starting at the last graticule.

m. Depress the SYNC PATTERN SELECT pushbuttons 2 through 20, in succession and verify that the corresponding bit appears on the oscilloscope.

NOTE: Each time a SYNC PATTERN SELECT pushbutton is depressed, the START XMIT pushbutton must be depressed to enter the new state into the shift register.

n. Release all the odd numbered SYNC PATTERN SELECT pushbuttons.

o. Connect the CLOCK output to the input of the counter. Set the clock rate controls for a 10.5 MHz reading on the counter. Disconnect the CLOCK output from the counter and connect the SYNC output.

p. Select the following word lengths and verify the following counter indications.

Word Length	Counter Indication (approx)
511	20,550 Hz
2,047	5,124 Hz
32,767	320 Hz
131,071	70 Hz
1,048,575	10 Hz

3.3 RECEIVE OPERATION

a. Set the instrument controls as follows:

Controls	Setting
CLOCK RATE	EXT
MODE	RCV
SYNC PATTERN SELECT	no. 1 depressed; all others released
WORD LENGTH SELECT	1,048,575

b. Connect the clock and data outputs of the random data source to the CLOCK and DATA inputs.

c. If another Model 217 is used as the random data source, set the controls as follows:

Control	Setting
CLOCK RATE	1 MHz
VERNIER	fully clockwise
MODE	XMIT
SYNC PATTERN SELECT	all released
WORD LENGTH SELECT	1,048,575

d. Connect the ERROR output to the oscilloscope vertical input. Trigger the oscilloscope with the SYNC output.

e. Depress the START XMIT pushbutton, then the SYNC RESET pushbutton.

f. If error pulses are present, adjust the CLOCK SKEW controls to minimize the errors (start with the lowest clock skew range). Depress the START XMIT and SYNC RESET pushbuttons.

g. If errors are still present, repeat step (f) until no errors are present.

SECTION IV

CALIBRATION

4.1 EQUIPMENT (or equivalent) REQUIRED

a. Oscilloscope with a bandpass capability of dc to 50 MHz. Tektronix 546 with a Type 1A2 plug-in recommended.

b. A X1 oscilloscope probe. Tektronix Type P6028 recommended.

c. Electronic counter capable of reading 25 MHz. Systron-Donner 7015 recommended.

d. Digital voltmeter. Systron-Donner 7000A recommended.

e. Fifty ohm, 1 watt termination. Tektronix Type 017-0078-00.

f. Two 50 ohm coaxial cables terminated with BNC connectors.

g. Autotransformer.

4.2 POWER SUPPLY CALIBRATION

CAUTION

Verify that the 115/230 volt slide switch on the back panel agrees with the power source prior to connecting the power plug.

a. Connect the instrument power plug to the autotransformer and the autotransformer to the power source.

b. Adjust the autotransformer to 115 or 230 volts and actuate the instrument POWER switch to ON.

c. Connect the digital voltmeter to the 15.5 volt buss and adjust R523 for 15.5 volts dc.

d. Connect the digital voltmeter to -15.5 volt buss and adjust R541 for -15.5 volts dc.

4.3 OSCILLATOR CALIBRATION

a. Connect the CLOCK output to the input of the counter.

b. Select the 10 kHz clock rate range and rotate the vernier fully clockwise. Adjust R6 for 10.5 kHz.

c. Select the 25 MHz clock rate range and adjust C7 and C8 for 25 MHz.

d. Check the remaining ranges and verify that each range overlaps at the upper and lower limits.

4.4 DELAY ONE-SHOT CALIBRATION

a. Connect point X (reference schematic 40000-433) and the CLOCK output to the inputs of the dual trace oscilloscope. Trigger the oscilloscope with the CLOCK output.

b. Set the instrument controls as follows:

Control	Setting
CLOCK RATE VERNIER	1 kHz fully clockwise
CLOCK SKEW VERNIER	50 μs fully clockwise

c. Adjust R130 for a delay of approximately 52 μs between the clock output pulse and the pulse at point X.

d. Check the upper and lower limit of each range, except the 50 ns range and verify each range overlaps at the upper and lower limit.

e. Set the CLOCK RATE controls for 1 MHz.

f. Set the CLOCK SKEW for 50 ns and the vernier fully clockwise. Adjust C194 for approximately 52 ns.

SECTION V

THEORY OF OPERATION

5.1 GENERAL DESCRIPTION

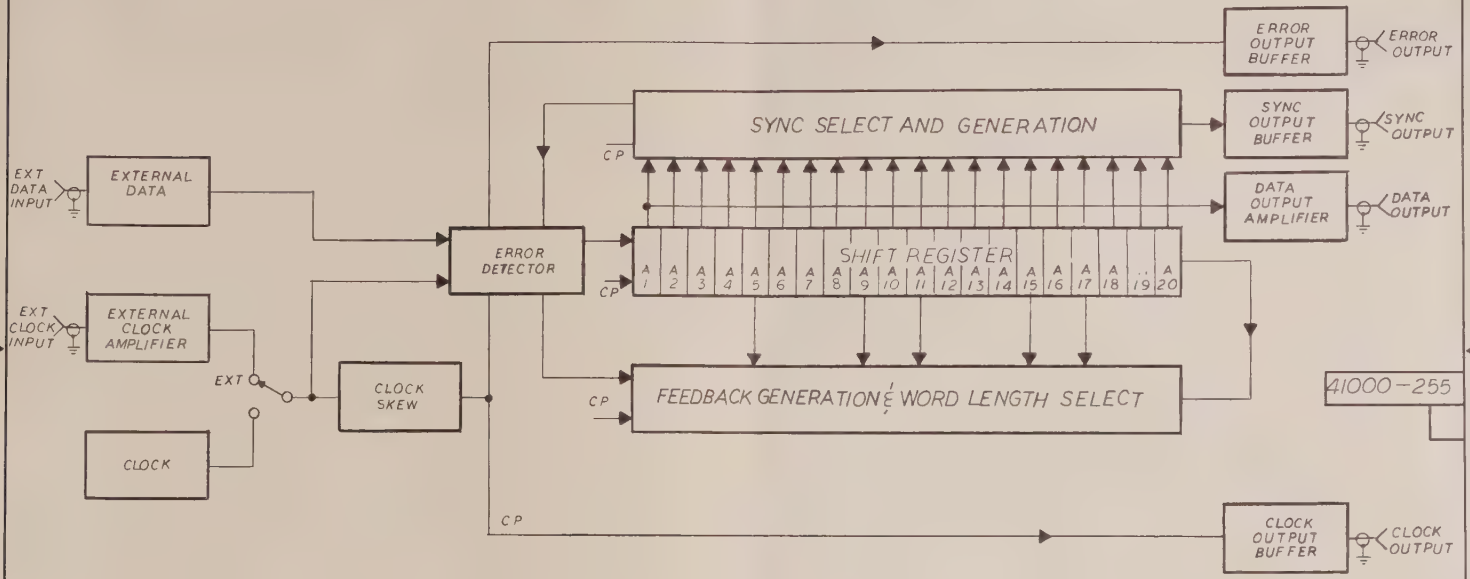
In the Model 217, the pseudo-random sequence is generated by a 20 stage shift register. Feedback is provided for the shift register input by a mod 2 adder. The feedback consists of two selected shift register stages that are exclusively OR'ed. The shift register stages selected to be fed back determines the length of the pseudo-random sequence. If only the 20th shift register stage is fed back, the instrument becomes a 20 bit word generator.

Time reference for the instrument is provided by the internal oscillator or an external clock source. The clock pulses are standardized by a Schmitt trigger circuit, then fed to the clock skew circuit where the pulses are shaped and used to drive a one-shot multivibrator. The clock skew circuit provides for delaying of the clock pulses to align them with the incoming data when the instrument is in the receive mode.

In the receive mode, the external data and the output of the shift register are compared by an exclusive OR circuit. Any differences between the two inputs show up as error signals at the error output.

The point on the internal or external data where the sync pulse will occur is determined by the setting of the sync pattern select pushbutton. The sync circuits monitor each stage of the shift register and when the incoming data matches the preselected sync pattern a sync pulse is generated.

REVISIONS				
E.C.N.	SYM	DESCRIPTION	DATE	APPROVED
	—	INITIAL REL. E.O. 1706	13 AUG 70	AB


ERROR OUTPUT BUFFER
ERROR OUTPUT
SYNC SELECT AND GENERATION
SYNC OUTPUT BUFFER
SYNC OUTPUT
DATA OUTPUT AMPLIFIER
DATA OUTPUT
EXT DATA INPUT
EXTERNAL DATA
CP
ERROR DETECTOR
SHIFT REGISTER
A 1 A 2 A 3 A 4 A 5 A 6 A 7 A 8 A 9 A 10 A 11 A 12 A 13 A 14 A 15 A 16 A 17 A 18 .. A 20
EXT CLOCK INPUT
EXTERNAL CLOCK AMPLIFIER
EXT
CLOCK SKEW
CLOCK
FEEDBACK GENERATION & WORD LENGTH SELECT
41000-255
CP
CLOCK OUTPUT BUFFER
CLOCK OUTPUT

NOTES: UNLESS OTHERWISE SPECIFIED

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
3 PLACE DEC. ± — | 2 PLACE DEC. ± — | ANGLES ± —
MATERIAL
FINISH
DO NOT SCALE DWG.

DRAWN		
CHECKED	AB	13 AUG 70
APPROVED		
APPROVED		
RELEASED	E.O. 1706	13 AUG 70

TITLE: BLOCK DIAGRAM — DATA GENERATOR
217

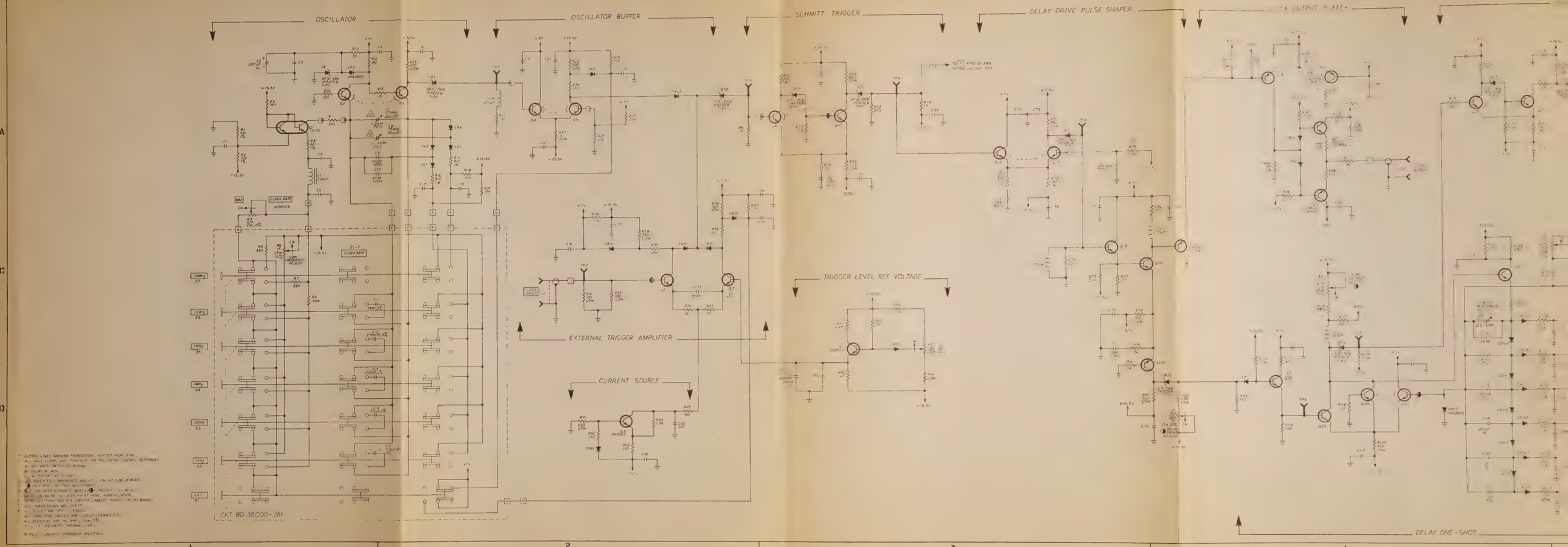
SCALE NONE | CODE 15933

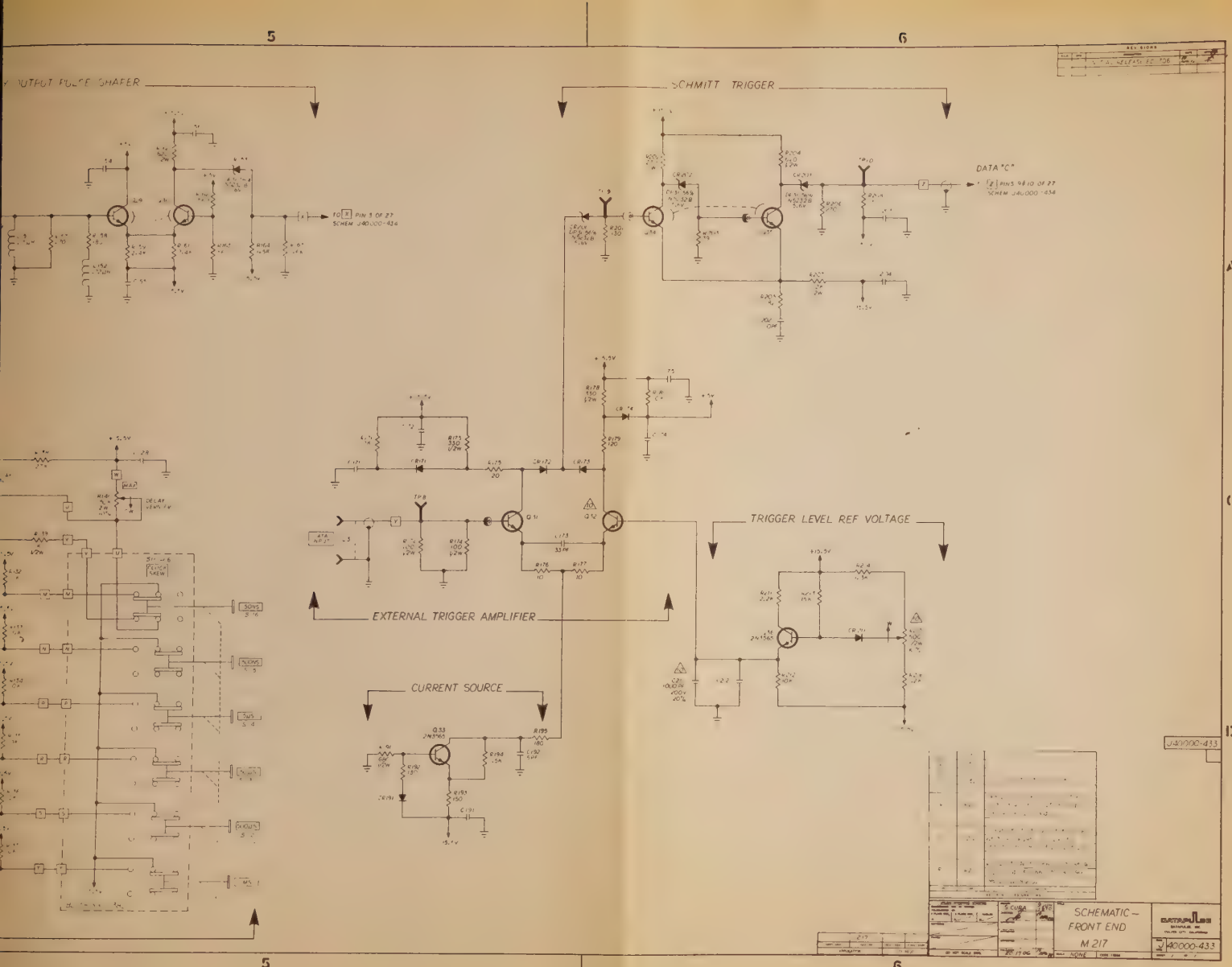
DATAPULSE
DATAPULSE, INC.
CULVER CITY, CALIFORNIA

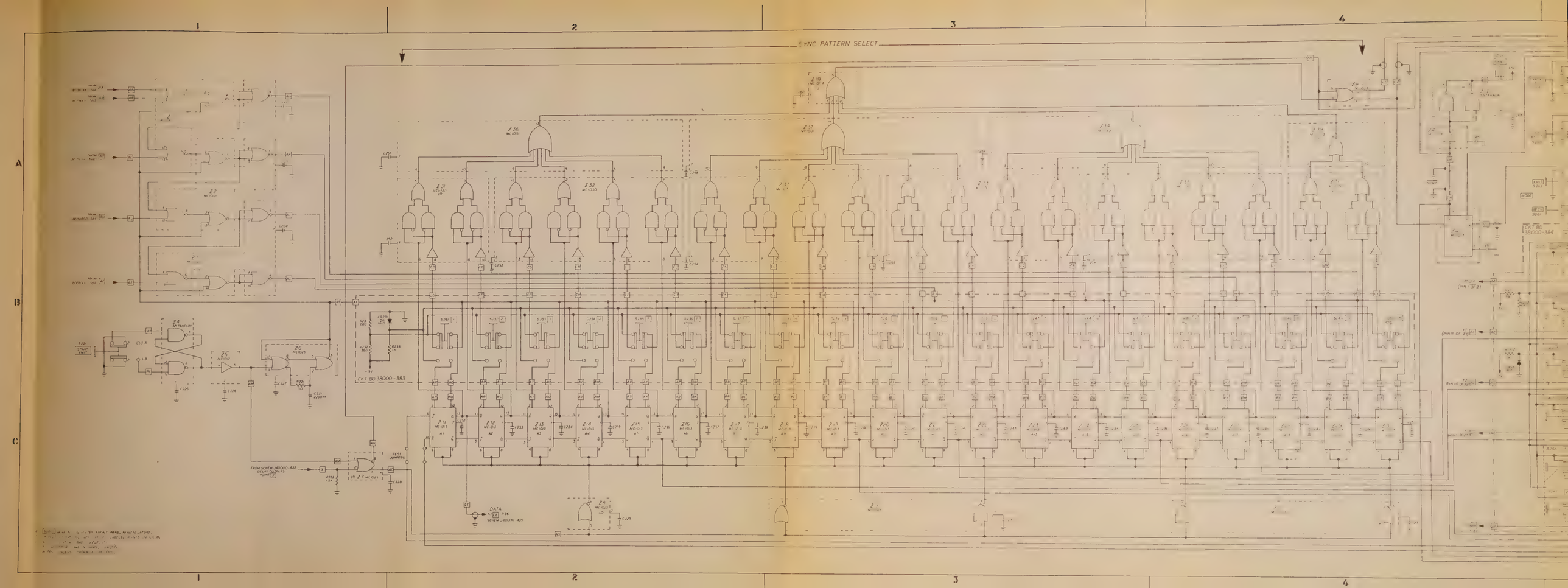
DWG SIZE C | 41000-255

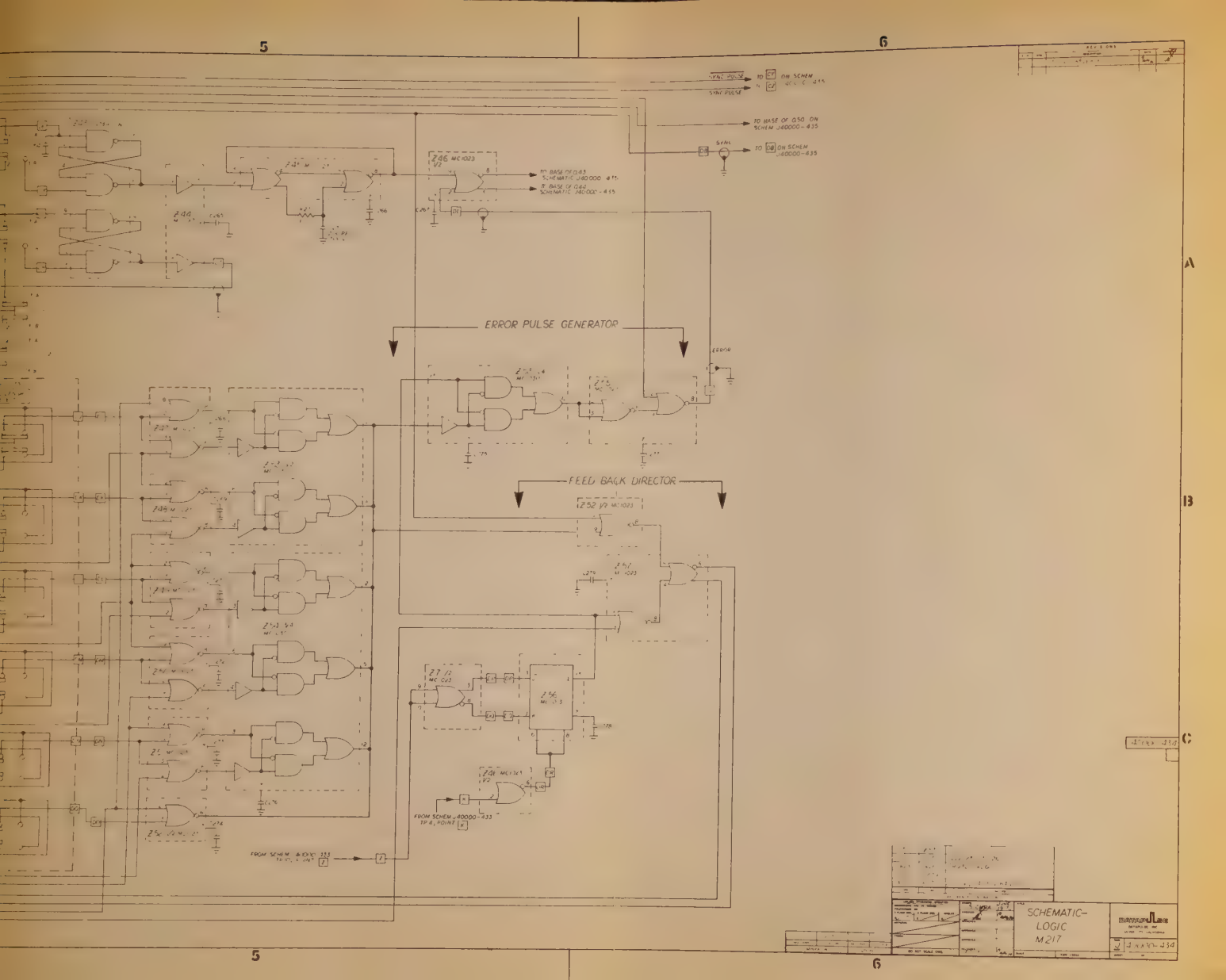
SHEET OF

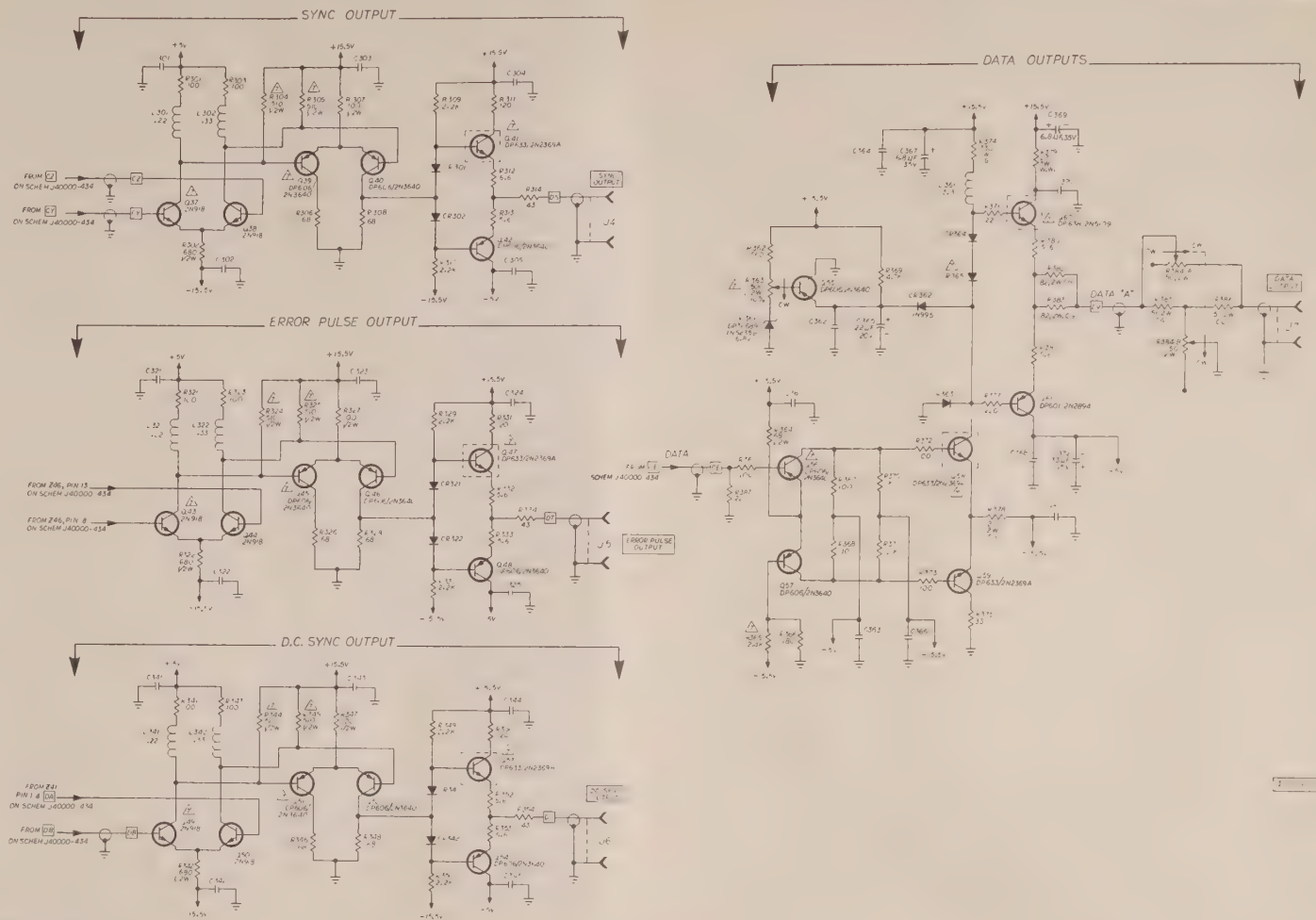
K+E LA 3177


OSCILLATOR
OSCILLATOR BUFFER
SCHMITT TRIGGER
DELAY DRIVE PULSE SHAPER
TRIGGER LEVEL REF VOLTAGE
EXTERNAL TRIGGER AMPLIFIER
CURRENT SOURCE
DELAY ONE-SHOT
CKT BD 38000-381


OUTPUT PULSE SHAPER
SCHMITT TRIGGER
DATA "C"
TRIGGER LEVEL REF VOLTAGE
EXTERNAL TRIGGER AMPLIFIER
CURRENT SOURCE
SCHEMATIC – FRONT END
M 217
J40000-433


SYNC PATTERN SELECT
CKT BD 38000-383
CKT BD 38000-384
DATA
TEST JUMPER

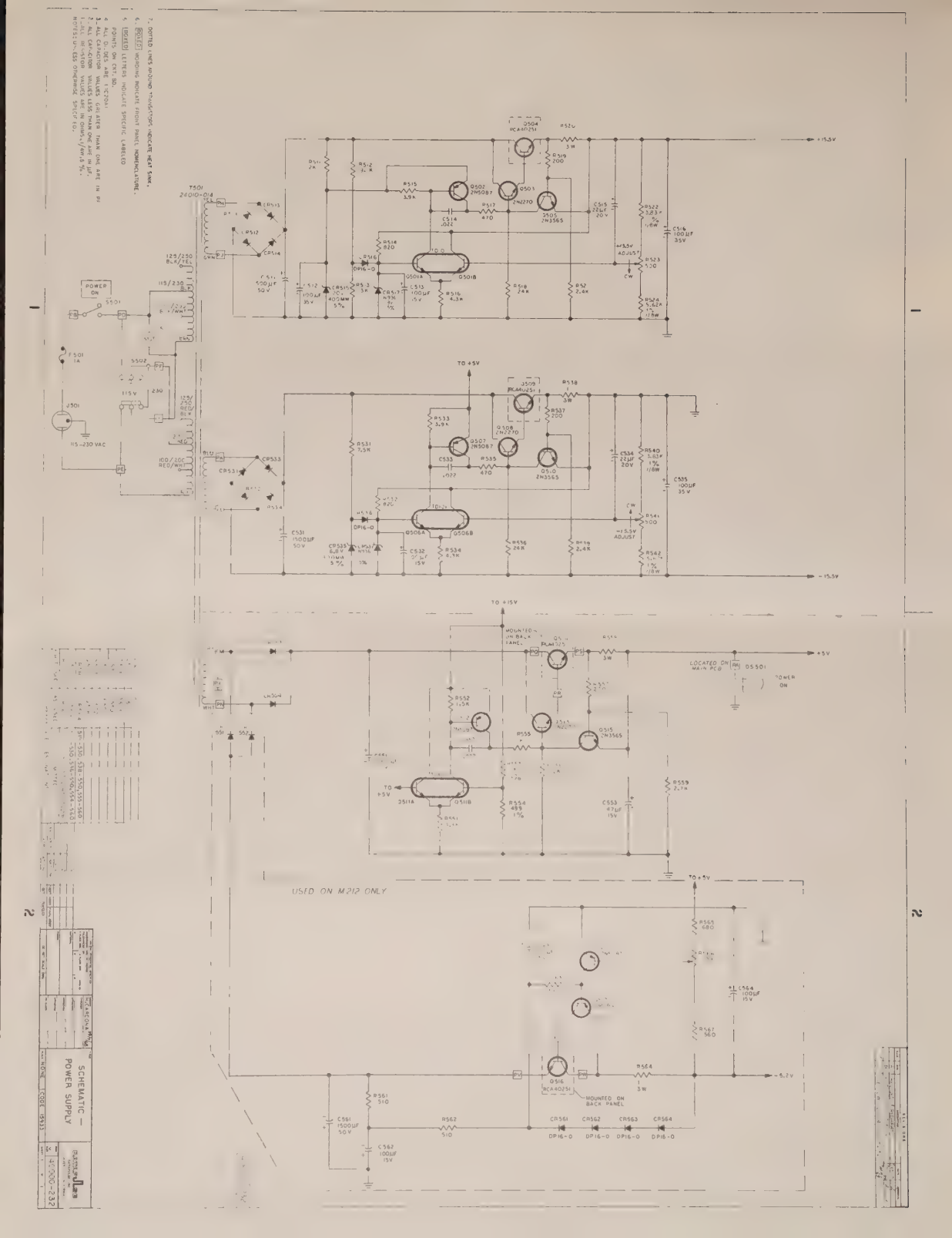

5
6
A
B
C
SYNC PULSE
TO BASE OF Q43 SCHEMATIC J40000-435
TO BASE OF Q50 ON SCHEM J40000-435
SYNC
TO ON SCHEM J40000-435
ERROR PULSE GENERATOR
ERROR
FEED BACK DIRECTOR
FROM SCHEM J40000-433 TP 4, POINT K
FROM SCHEM J40000-433
SCHEMATIC-
LOGIC
M217



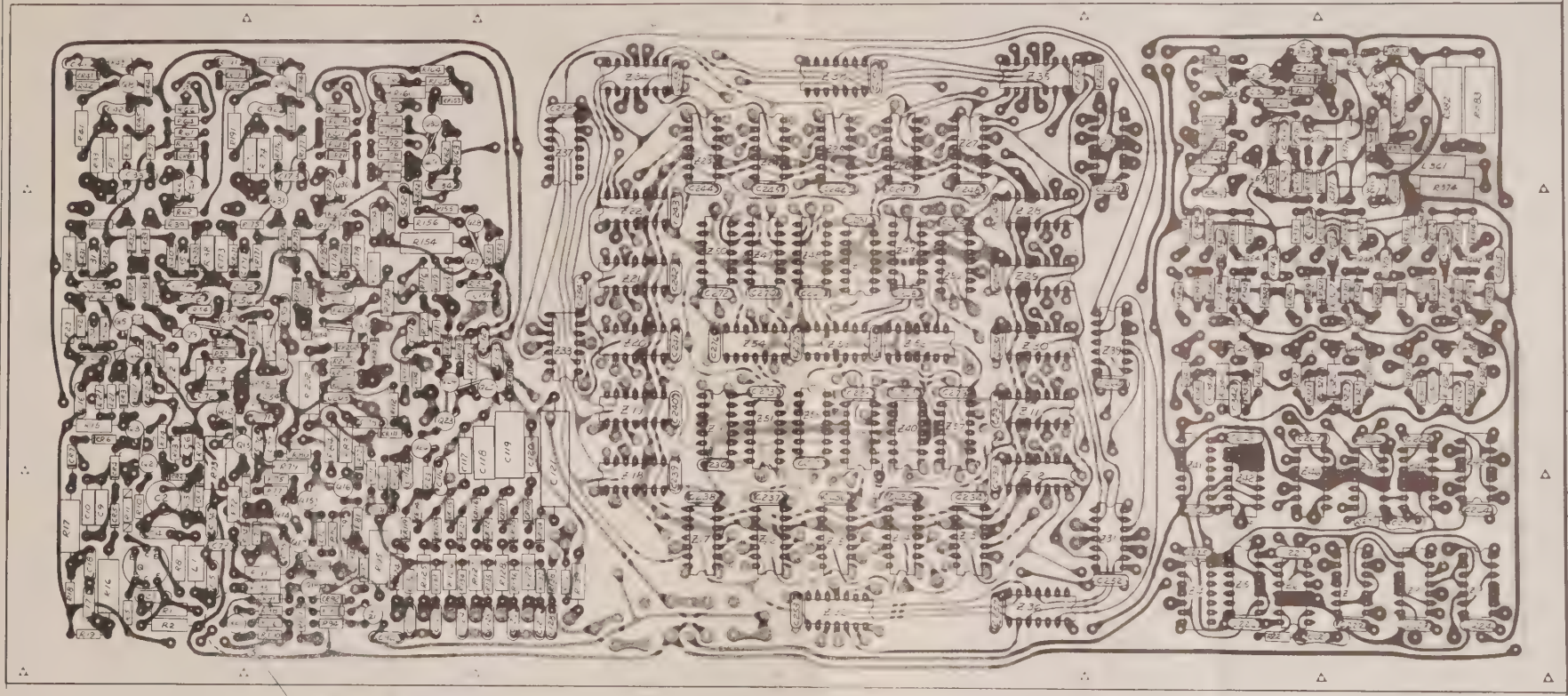
B- DOTTED LINES AROUND TRANSISTORS INDICATE HEAT SINK.
△- INDICATES COMPONENTS TO BE MOUNTED ON CKT SIDE OF THE BOARD.
6. BOARD WORDING INDICATES FRONT PANEL NOMENCLATURE.
7. BOARD LETTERS INDICATE SPECIFIC LABELED POINTS ON CKT. BD.
4- ALL INDUCTOR VALUES ARE IN μH.
5- ALL DIODES ARE DFI6-01 IN5400.
2- ALL CAPACITORS ARE .022 μF, 25V.
1- ALL RESISTORS ARE IN OHMS, 1/4W, 5%
NOTES: UNLESS OTHERWISE SPECIFIED.

SCHEMATIC-
OUTPUTS
M2.7

40000-435


NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTOR VALUES ARE IN OHMS, ±5%, 1/4W.
2. ALL CAPACITOR VALUES LESS THAN ONE ARE IN µF.
3. ALL CAPACITOR VALUES GREATER THAN ONE ARE IN µF.
4. ALL DIODES ARE 1N4001.
5. ALL TRANSISTORS ARE 2N3565.
6. (BOXED) LETTERS INDICATE SPECIFIC LABELED POINTS ON CKT. BD.
7. DOTTED LINES AROUND TRANSISTORS INDICATE HEAT SINK.
6. (BOXED) MOUNTING INDICATE FRONT PANEL NOMENCLATURE.
T501 24010-014
POWER ON
S501
F501 1A
J501
115-230 VAC
115/230
125/250 BLK/YEL
S502
230
115V
125/250 RED/BLK
100/200 RED/WHT
CR511
CR512
CR513
CR514
CR515
CR516
CR517
CR518
C511 500µF 50V
C512 1100µF 35V
C513 100µF 15V
C514 .022
R511 2K
R512 3.3K
R513 3K
R514 820
R515 3.9K
R516 DP16-0
R517 470
R518 24K
R519 200
R520 3W
R521 2.4K
R522 5.23K 1% 1/8W
R523 100
R524 1.62K 1% 1/8W
Q501A
Q501B
Q502 2N5087
Q503 2N2270
Q504 RCA40251
Q505 2N3565
C515 22µF 20V
C516 100µF 35V
+15V ADJUST
CW
+15.5V
TO +5V
TO -15V
R531 7.5K
R532 820
R533 3.9K
R534 4.3K
R535 470
R536 24K
R537 200
R538 3W
R539 2.4K
R540 3.01K 1% 1/8W
R541 100
R542 1.62K 1% 1/8W
-15.5V ADJUST
C531 1500µF 50V
C532 .047 15V
C533 .022
C534 22µF 20V
C535 100µF 35V
CR531 100/200 RED/WHT
CR533
CR534
CR535 6.8V 1/2W 5%
Q506A
Q506B
Q507 2N5087
Q508 2N2270
Q509 RCA40251
Q510 2N3565
MOUNTED ON BACK PANEL
LOCATED ON MAIN PCB
Q5501
POWER ON
+5V
R552 1.5K
R553 270
R554 499 1%
R555
R556 270
R557 270
R558 3W
R559 2.7K
Q511A
Q511B
Q515 2N3565
C553 47µF 15V
USED ON M212 ONLY
R560 680
R561 510
R562 510
R563 270
R564 3W
R565 560
R566 270
R567 560
C561 1500µF 50V
C562 100µF 15V
C564 100µF 15V
Q516 RCA40251
MOUNTED ON BACK PANEL
-5.2V
CR561 DP16-0
CR562 DP16-0
CR563 DP16-0
CR564 DP16-0
SCHEMATIC — POWER SUPPLY
CODE 05533
SIZE D
SCALE NONE
SHEET 1 OF 1
REV
A
B
C
D
1
2

REVISIONS				
ECN	DIN	DESCRIPTION	DATE	APPROVAL
	A	REVISED & REDRAWN	1/27/70	
	B	N.T.A. RELEASE EO 1710	8/10/70	



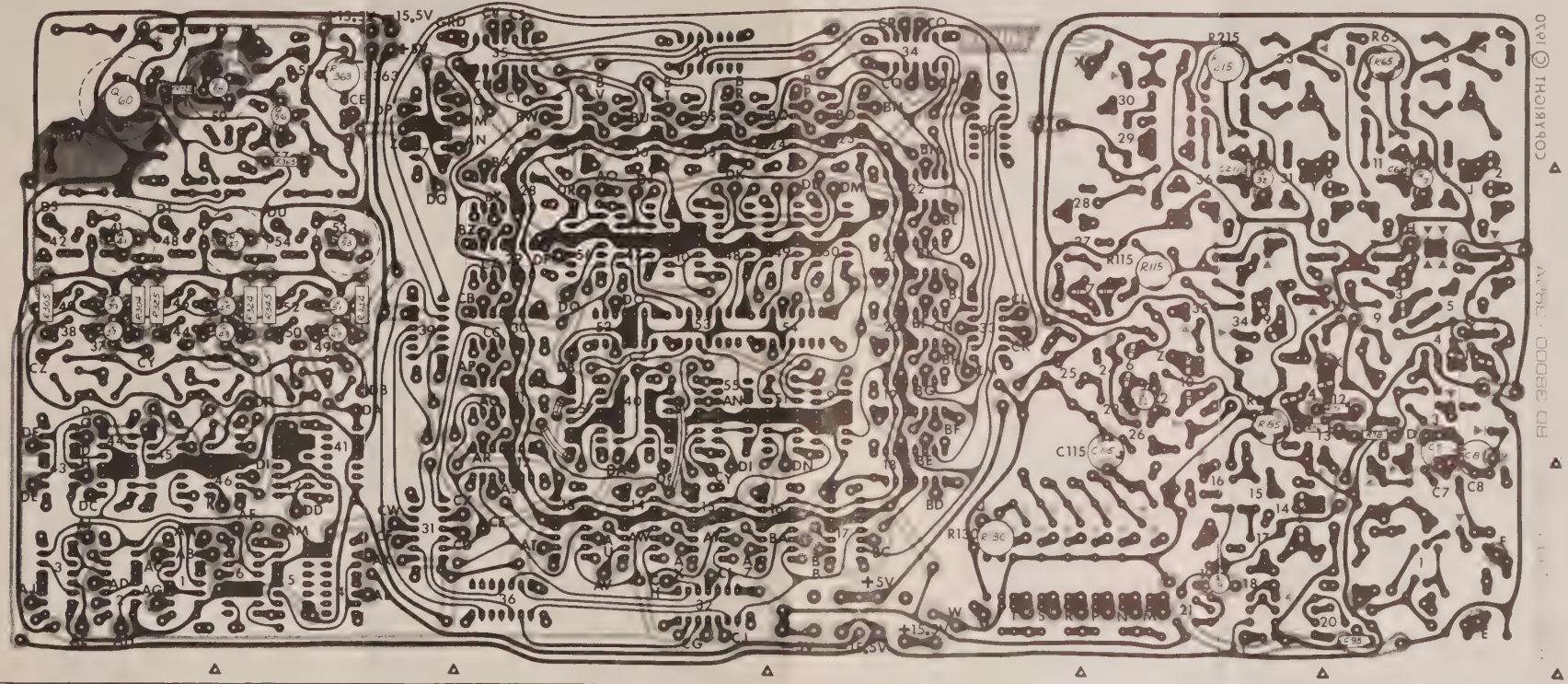
9 - HEAT SINK TO-18 = FOR Q 41, 47, 53, 58, LOCATED IN BACK OF THE BD, FOR Q20 IN FRONT.
8 - HEAT SINK TO-5 = Q60.
7 - DUAL TRANSISTOR PAD = Q1.
6 - TRANSISTOR PADS TO-5 = Q60.
5 - TRANSISTOR PADS TO-18 = 42, 3, 7, 8, 11, 12, 14, 24, 26, 32, 34, 59, 61.
4 - INDICATES TRANSISTOR THERMAL LINK.
3 - INDICATES TEST POINTS.
2 - INDICATES 1/2 FERRITE BEAD.
1 - INDICATES A FULL FERRITE BEAD.
NOTES UNLESS OTHERWISE SPECIFIED

SEE SEPARATE PARTS LIST "A" SIZE, SHTS 3 THRU 14 OF THIS DWG.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON 3 PLACE DEC ± .005 2 PLACE DEC ± .01 ANGLES ± 1°	DRAWN SCURA 1/27/70	TITLE CKT BD ASSY- MAIN BD M 217	DATAPULSE DATAPULSE INC. CULVER CITY, CALIFORNIA
MATERIAL	CHECKED		SIZE D 37000-843
FINISH	APPROVED		SHEET 1 OF 14
DO NOT SCALE DWG.	APPROVED		
NEXT ASSY	MFG ENGR E 1710 8/10/70	SCALE 2 : 1	
APPLICATION	QTY REQD		

A 37000-843

REVISIONS					
ECN	DIM	DESCRIPTION		DATE	APPROVAL
		SEE SHT 2 OF 14			



A 37000-843

NOTES UNLESS OTHERWISE SPECIFIED

37000-845	217	1	1
NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

DO NOT SCALE DWG.

MFG SOLICURA 7-70
CHECKED
APPROVED
APPROVED
APPROVED
ENG RELEASE EG1710

TITLE
CKT BD ASSY-
MAIN BD
M217

SCALE 2:1

DATAPULSE INC
CULVER CITY, CALIFORNIA

DWG D 37000-843
SIZE
SHEET 2 OF 14

E. O. NO.	EFFECTIVE DATE	DWG. NO.	CHANGE
4008	9-9-70	37000-843	Change resistor 120 ohm, ¼ w marked C351 to R351.
4003	9-2-70	40000-433	Enter near Q18: "DP606/2N3640". Change R160, 620, ½ W to R160, 560, ½ W.

SEMICONDUCTOR REPLACEMENTS

(Applicable to all Datapulse Models except the Model 102).

FROM DATAPULSE DIVISION

SERVICE BULLETIN NO. 1-65
Revised 2-19-70

The listed commercial equivalent diodes and transistors are suitable replacements for the corresponding Datapulse parts, either as direct substitutes, or as selected for the special performance characteristics given.

DATAPULSE TYPE NO.	DATAPULSE PART NO.	COMMERCIAL EQUIVALENT
Diodes:		
DP15-0	22154-000	1N752A selected for $\Delta V < 0.2V$ between 7mA and 110mA.
DP15-1	22154-001	Same as DP15-0 but matched in pairs to within 0.1V.
DP15-201	22154-201	1N936 selected for 9.4V±0.1V @25mA.
DP16-0	22164-000	1N3600
DP16-1	22164-001	1N3604
DP16-2	22164-002	HPA1003
DP19-0	22194-000	1N2070/1N4005
DP19-1	22194-001	1N4002
DP19-6	22194-006	1N2071/1N4005
Transistors:		
DP43-0	22435-000	2N984
DP46-0	22465-000	2N2964A
DP46-1	22465-001	Selected for h_{fe} = 100 min.
DP59-0	22595-000	2N2904A
DP60-0	22605-000	2N2411
DP60-1	22605-001	2N2894 selected for V_{ceo} (sust) = 20V min.
DP60-2	22605-002	2N2904 or 2N3133
DP60-3	22605-003	2N2894
DP60-4	22605-004	2N3209
DP60-5	22605-005	FT1702
DP60-6	22605-006	2N3640
DP60-7	22605-007	2N2894 selected for V_{ceo} (sust) = 25V.
DP63-0	22635-000	2N2369 or 2N2501
DP63-1	22635-001	2N3723
DP63-2	22635-002	Replaced by DP63-3
DP63-3	22635-003	2N2369A (Fairchild)
DP63-4	22635-004	2N3646 or 2N2369A
DP63-6	22635-006	2N2270
DP63-7	22635-007	2N3261 selected for C_{OB} of 3.3pF or less
DP63-8	22635-008	May be replaced by 2N5109 selected for $h_{fe} \geq 20$ @I_c = 0.25A & V_c = 2.5V
DP63-9	22635-009	May be replaced by 2N5109 selected for $h_{fe} \geq 20$ @I_c = 0.25A & V_c = 2.5V
DP64-0	22645-000	May be replaced by 2N5109 selected for $h_{fe} \geq 20$ @I_c = 0.25A & V_c = 2.5V

DATAPULSE DIVISION
SYSTRON DONNER CORPORATION

10150 W. Jefferson Blvd., Culver City, California 90230
Phone: (213) 836-6100 • TWX: 910-340-6766

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Phone: 71-76-84 • Telex: 23606 Belgium

WARRANTY

The Datapulse Division, Systron-Donner Corporation (hereinafter referred to as Datapulse) warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this Warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to making good at our factory any part or parts thereof except tubes, transistors, fuses or batteries which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective.

Instruments returned under this Warranty will not be accepted at the Datapulse plant without prior authorization by a Datapulse representative or by the service manager of Datapulse.

Datapulse reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of Datapulse and Datapulse neither assumes nor authorizes any other person to assume for them any other liability in connection with the sales of Datapulse instruments.

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